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Treatability Study Bulletin

Mobile Volume Reduction Unit at the Sand Creek Superfund Site

Technology Description: The Risk Reduction Engineering Laboratory (RREL) Releases Control Branch (RCB) has developed a pilot-scale Mobile Volume Reduction Unit (VRU) to determine the feasibility of soil washing for the remediation of contaminated soils. This mobile unit, mounted on two trailers, can process 100 lb/hr of soil feed. Soil washing is a cost effective technology used in conjunction with other methods for remediating contaminated soil. The process reduces the quantity of contaminated material that must be processed by more expensive technologies, such as incineration or bioremediation. In some cases, soil washing may be a successful stand-alone technology.

Region VIII of the United States Environmental Protection Agency (EPA) requested the VRU to evaluate soil washing as a treatment for contaminated soil at the Sand Creek Superfund Site in Commerce City, CO. This site contains approximately 14,000 yd^3 of soil contaminated with pesticides. Soil washing, a relatively inexpensive technology, might provide a significant cost savings by reducing the volume of soil requiring expensive treatment by incineration. Region VIII defined the objectives of the test:

- Determine if the soil washing is effective in removing heptachlor and dieldrin from contaminated soil.
- Determine whether the VRU can achieve the cleanup goals set for the site: less than 0.553 ppm heptachlor and less than 0.155 ppm dieldrin.
- Estimate the process parameters and cost factors for the full-scale operation.
- Provide data for process scale-up.

The system, illustrated in Figure 1, begins by screening the excavated soil to remove debris and large objects greater than 1/4 inch. The soil, fed into a hopper, is transferred by screw conveyor to the soil washer feed hopper, where the surfactant water and alkali are added. A ribbon blender in the hopper mixes the soil and additives. A screw feeder, with speed control, then feeds the mix into the soil washer's rotating trommel, where the wash water is added. The washed slurry flows by gravity to vibrating screens for the separation of the cleaned coarse soil from the fines and wash water, which contain the contaminants.

After sampling, the washed coarse soil and the fines slurry were held onsite pending further treatment. The VRU provides a fines slurry treatment system for separation of solids and dissolved contaminants from the effluent water. This slurry treatment system was not utilized.

Two alkalis, sodium carbonate and sodium hydroxide were used to raise the pH. Three surfactants, Tergitol NP-10, Sodium Laurel Sulfate, Adsee 799/Witconol NP-100, were used.

Evaluation of Test Results: The VRU treated Sand Creek soil during 23 2-hr tests over a 2-wk period in late September 1992. EPA investigated the following variables:

- Surfactant concentration — 0 to 1.5 wt% of water
- Three surfactants — two nonionic and one anionic
- Wash fluid temperatures — 70 to 130 °F
- pH — 7 to 10
- Liquid to solids weight ratio — 6:1 to 9:1
- Soils depths — 0-1 ft, 1-3 ft, 0-5 ft

Technicians collected four types of samples: feed soil, screen overflow—coarse soils (>200 mesh); screen underflow (fines); and effluent water. Laboratory analyses measured particle size distribution and moisture content as well as the presence of heptachlor, dieldrin, and other pesticides.

The three feed soils had equivalent particle size distributions: 30% to 35% by weight less than 74 microns (~200 mesh). The primary test soil, used in 19 runs, contained approximately 250 ppm heptachlor and 20 ppm dieldrin. The other two soils, used in Runs 13 to 16, were obtained from depths below the primary test soil where the contaminant concentrations were an order of magnitude lower.

With surfactant concentrations of approximately 1.0% by weight of water, the VRU washed more than 90% of the heptachlor and dieldrin from the coarse soils with residuals averaging 20 ppm and 2 ppm respectively. Without surfactant, removal efficiencies of 75% to 80% were obtained. The three surfactants achieved similar extraction efficiencies. The results for the two secondary soils indicated removal efficiencies equivalent to that achieved with the primary soil. The results of varying pH, temperature, and the liquid to solids ratio were inconclusive.

The site cleanup goals were not met. However, the test soil came from the most contaminated areas on the site. Other areas are significantly less contaminated. Therefore, soil washing may still be effective in reducing the quantity of Sand Creek soil requiring processing by incineration.

For two runs, the washed coarse soil was processed a second time through the washer. Contaminant removal efficiency increased less than 50%. Several washed coarse soil samples were subjected to a rinse at the laboratory. One run, using the

0 - 5 ft soils, appeared to achieve the action levels for both contaminants.

Conclusions:

- The soil washing with 1% surfactant achieved >90% removal for the target contaminants.
- Soil washing did not reduce the coarse soil (>200 mesh) contaminant concentrations to levels that met the cleanup goals at the Sand Creek Site. Required removal efficiencies (> 99%) were beyond the capabilities of the VRU.
- Addition of a surfactant improved the cleanup levels for heptachlor and dieldrin.
- Double washing provided only a modest increase in contaminant removal efficiency.
- Rinsing the coarse soils resulted in a significant reduction of heptachlor and dieldrin.

EPA will publish a report to provide a more detailed discussion of the Sand Creek test. The report will be available from the National Technical Information Service in Springfield, VA.

For Further Information:

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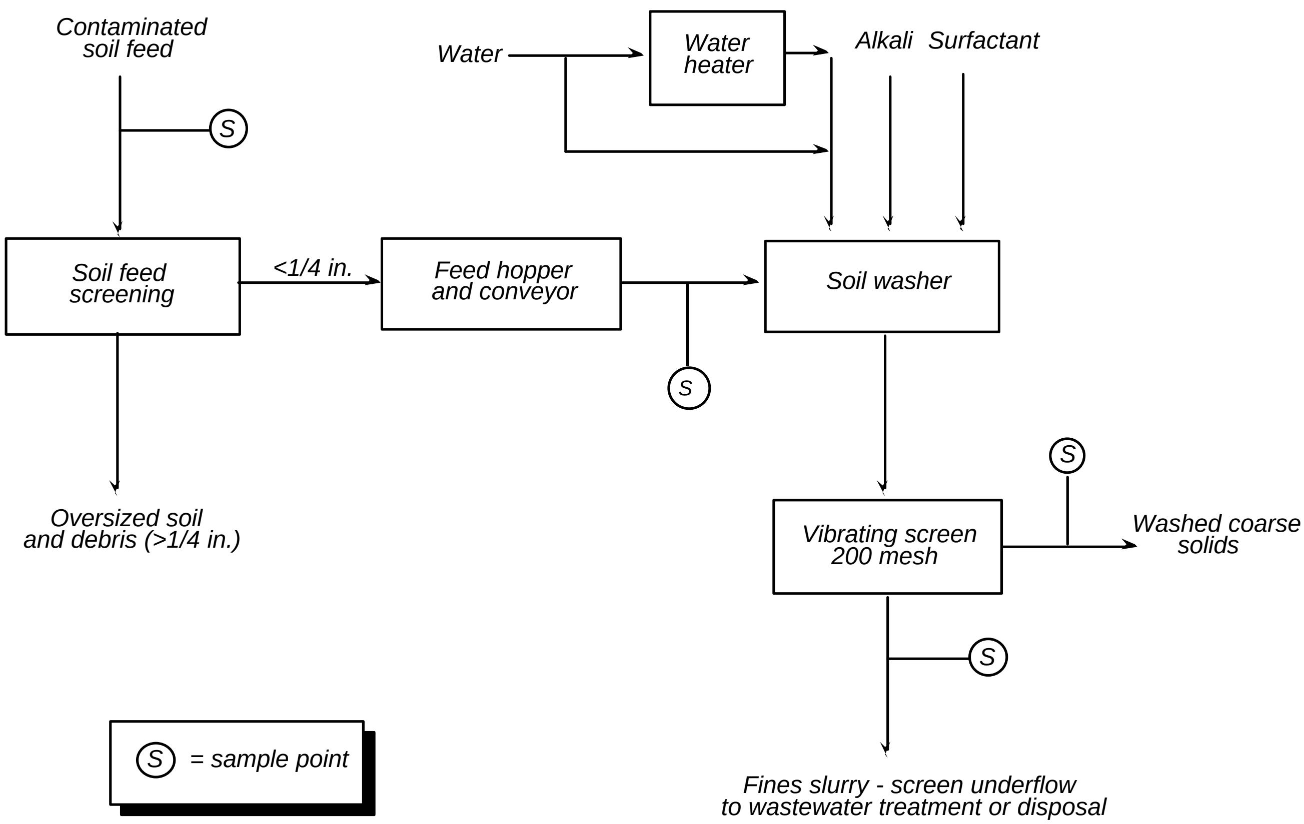

Figure 1. *VRU process.*

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